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Cognitive predictors of success in learning Russian in native and non-native speakers at high school age

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Abstract

The study focused on the role of the speed of information processing, working memory and non-verbal intelligence in the success in learning Russian assessed with teacher ratings (annual grades) and state exam scores in native and non-native speakers at high school age. Russian-speaking students, who study in different educational environments, differed in non-verbal intelligence, but not the speed of information processing and working memory. Russian-speaking students, who study in Kyrgyzstan, showed better performance at the Russian language exam, than their Kyrgyz-speaking peers. Non-verbal intelligence predicted success in learning Russian across all groups.

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Keywords: success in learning Russian; native and non-native speakers; speed of information processing; working memory; intelligence; high school age.

1. Introduction

The problem of the relationship between cognitive development and success in learning the mother tongue is particularly crucial at school age. On the one hand, the mother tongue is a means of processing, storage and transmission of information. On the other hand, language acquisition can be associated with individual differences in cognitive functioning. A number of studies have shown that success in learning is associated with cognitive characteristics such as intelligence (Malykh et al., 2012), working memory (Bull et al., 2010), speed of information

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processing (Semmes et al., 2011), and the strength of these associations depends on test tasks (Verbitskaya et al., 2015), age (Rodic et al., 2014) and academic discipline (Tikhomirova et al., 2015).

The majority of studies analyzed the success in learning in terms of mathematical achievement on different socio-cultural samples. The analysis of the success in learning Russian in school students, who are native or non-native speakers, is limited by a socio-cultural context related to a particular language. Partially for this reason there are few studies of cognitive predictors of success in learning Russian. L.A. Verbitskaya and her colleagues (2015) studied the cognitive predictors of the success in learning Russian on a sample of Russian high school students.

The current study aims to analyze the role of cognitive characteristics such as speed of information processing, working memory and non-verbal intelligence in the success in learning Russian measured with annual grades and test scores on standardized state exams in native and non-native speakers at high school age. We investigated the relationship of the measures in high school students from two countries – Russia and Kyrgyzstan – that have similar educational systems, but are different in terms of the quality of education (PISA, 2010).

2. Methods

2.1 Participants

Three samples of final-year students (Grade 11) were enrolled from public secondary schools: 1) 203 Russian students (Mean = 17.7 years, SD = 0.4, 49.5% males), who study in Russian in Russia, 2) 94 Russian students (Mean = 17.6 years, SD = 0.5, 47.2% males), who study in Russian in Kyrgyzstan, and 3) 215 Kyrgyz students, who study in Russian in Kyrgyzstan (Mean = 17.7 years, SD = 0.5, 42.6% males).

2.2 Procedure

Data collection was conducted in educational institutions at the time of lessons strictly following the protocol under the constant supervision of a researcher.

Speed of information processing was measured using a computerized task ‘Choice Reaction Time’ (Tosto et al., 2013). In this task numbers 1,2,3,4 appear on the screen one at the time at a random interval between 1 and 3 seconds. The task requires to press the corresponding keys (1, 2, 3, 4 of the key board) as fast as possible. We analyzed the average response time for the correct answers.

Working memory was measured using a computerized ‘Corsi Block-Tapping Task’ (Tosto et al., 2013). The participants were presented a set of square blocks lighting up one after another. The test begins with a sequence of 4 blocks; the maximum possible number of elements in a sequence – 9. During the presentation the blocks light up for 1 second at intervals of 1 second. The participants were asked to repeat the presented sequence by clicking the blocks with a computer mouse. The test is automatically discontinued if a participant does not correctly reproduce the sequences at a particular level of difficulty. The program records the number of correct answers.

Non-verbal intelligence was measured using paper-and-pencil test ‘Raven's Progressive Matrices’. It consists of 60 tasks grouped in 5 series. Each correct answer was counted as 1 score. Total scores were calculated.

Success in learning Russian was indicated (1) by annual grades in Russian in both Russian and Kyrgyz samples, (2) by test scores of the Unified State Exam, USE (for Russian schoolchildren) and National testing (for Kyrgyz schoolchildren) which are obligatory school graduation exams.

The analysis of the results was carried out on the basis of anonymous personal data with prior written consent from the parents of the participants.

3. Results and discussion

3.1. Descriptive statistics

Table 1 shows means and standard deviations (in brackets) for all analyzed variables in native (Russian students from Russia and Kyrgyzstan) and non-native speakers (Kyrgyz students from Kyrgyzstan). The speed of information processing reflects the mean reaction time for correct answers on the test ‘Choice Reaction Time’. Working memory

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